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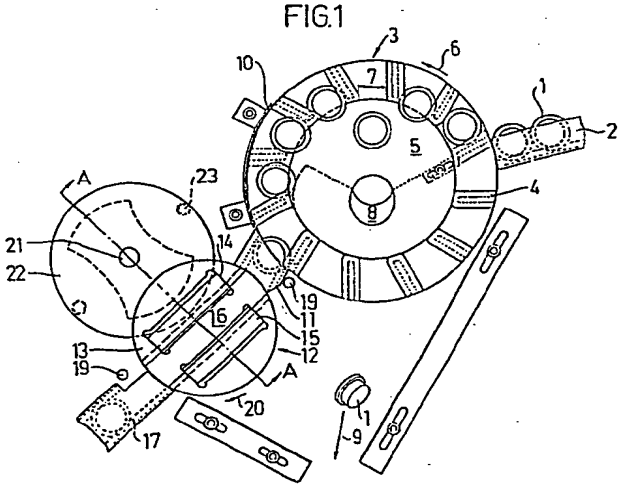
(54) **Method and apparatus for sorting round objects.**

(57) The invention relates to a method and apparatus for sorting round objects (1). In a first sorter (3) of the apparatus in accordance with the invention, objects (1) not meeting a given minimum dimension pass out of the apparatus and are taken away, whereas objects (1) meeting the given minimum dimension (7) are taken to a second sorter (12), through which only objects (1) which do not exceed a predetermined maximum dimension can pass. The second sorter (12) includes a pair of substantially parallel gauging members (14,15), between which acceptable objects (1) can pass, while objects which are too large are taken away from the sorter.

FIG.1



EP 0 334 825 A1

Description

Method and Apparatus for Sorting Round Objects

The present invention relates to a method and apparatus for sorting round objects, particularly a method and apparatus for sorting out round objects which do not meet a given minimum or maximum dimension.

The object of the invention has been to achieve a simple method and a simple apparatus for sorting out round objects which meet given dimension requirements, such as a predetermined minimum or maximum dimension. Also in accordance with the invention, it shall be especially possible to discover faults in roundness, i.e. ovality.

The method and apparatus according to the invention can be used for sorting out spherically shaped as well as circular-cylindrically shaped objects, and with regard to the latter, even such as have different diameters at different parts of the object, e.g. stoppers for bottles and the like.

The invention will now be described in the form of an embodiment example, which is not to be regarded as restricting the invention, and with reference to the accompanying drawings, where Figure 1 is a schematic side view of a sorting apparatus in accordance with the invention, implemented for sorting cylindrical stoppers having two different diameters; Figure 2 is a section A-A through a part of the apraratus in Figure 1; Figure 3 is a section B-B through the part illustrated in Figure 2; Figure 4 illustrates a part of the inventive apparatus in a different embodiment; and Figure 5 is a section through the part illustrated in Figure 4.

In Figure 1 there is illustrated a sorting apparatus in accordance with the invention. The objects to be sorted are stoppers 1, and as will be seen from the Figure they have a substantially cylindrical shape, where a portion of the stopper has a larger diameter than that of the other portion of it. An example of the use of such a stopper is for closing off bottles. Facing in the right direction these stoppers are placed on a chute 2, where they move under the action of gravity towards a first sorter 3.

This sorter includes a paddlewheel-like sorting member, provided in its outer circumferential region with fixed dogs 4. The dogs 4 are substantially radially disposed and extend a distance in towards the centre of the member, as far as a centrally arranged opening 5 in it. The dogs 4 are also mutually spaced for accomodating and taking with them the stoppers 1. The sorting member rotates continuously in the direction of the arrow 6, and a stopper 1 that has left the chute 2 and has come between two adjacent dogs 4 thus accompanies the rotation of the sorting member. The stopper also moves by gravity towards the centre of the sorting member and towards the central opening 5. The mutual spacing of the dogs is, however, such that the width of the opening towards the central opening 5 between two dogs is equal to the given minimum dimension 7 for the stoppers. The stoppers that do not comply with this dimension 7 fall down between respective adjacent dogs 5 into the central opening 5, and via a reject chute 8 are taken out from the apparatus in the direction of arrow 9. The stoppers meeting the given dimension 7 will remain between their respective dog pairs and are conveyed inthe direction of the arrow 6 as the sorting member continues to rotate. A fence 10 is arranged exterior to the circumference of the sorting member 9 to prevent the stoppers from falling down at an undesired place, and they are taken instead to a transfer device 11 for being led via it to a second sorter.

The transfer device 11 can be simple, i.e. a simple chute, which leads the stoppers 1,after they have passed through the first sorter and have met the minimum dimension, to the second sorter 12.

The second sorter 12 includes a disc 13 carrying two mutually movable members 14 and 15, in contradistinction from the fixed dogs 4, as will be explained below. The gauging members 14 and 15 mutually form a channel 16, along which the stoppers not exceeding a given maximum dimension can move. These stoppers roll by gravity to the other side of the disc 13 and out from the second sorter 12 to a discharge chute 17 for subsequently being taken to a n intended production station or the like.

As already mentioned, both gauging members 14 and 15 are mutually movably mounted on the rotatably disposed disc 13, but are kept biased towards each other in the normal case with the aid of springs 18, as will be seen from Figure 2, and in this position they form the channel 16 having the given maximum dimension for the stoppers 1 that are to pass along it. Sensing means are arranged at either end of the channel 16, and these sense whether a stopper passes along the channel or whether it fastens at the entry to the channel or in it. The sensing means 19, e.g. photocells, are mounted in positions which will be seen in Figure 1, and thus sense whether there is something in the channel 16. When a stopper is in the channel the beam between the photocells is interrupted, and with them it can thus be decided if a stopper has fastened or not. The beam between the photocells is of course interrupted even for a stopper with the correct dimension, which can thus pass along the entire channel. Some kind of time delay means must therefore be arranged to create a delay before sorting out takes place. This time delay can also be adjusted so that a stopper that does pass along the channel 16, but takes too long a time to do so, e.g. because it is somewhat oval, causes rejection. This rejection is thus activated by the beam between the photocells 19 having been interrupted for a longer time than a predetermined time. In such a case the disc 13 is rotated half a revolution in the direction of the arrow 20, simultaneously as the gauging members 14 and 15 are moved slightly apart to allow the release of a stopper that has fastened in the channel 16 and for the stopper to be discharged as a reject in the direction of the arrow 9. By the rotation of the disc 13, the end of channel 16 which was previously

nearest to the transfer device 11 will now face the discharge chute 17. Since the disc with the members mounted on it is symmetrical, the direction in which the disc faces does not matter. The rotation of the first sorter 3 is stopped when rejection is activated by the photocells, so that no new stoppers will arrive at the transfer device 11 and be transferred to the second sorter 12.

When an activating signal is sent as a result of the beam between the photocells 19 having been interrupted for too long a time an (unillustrated) electric motor is activated. This motor drives a shaft 21, on which is mounted a drive wheel 22 provided with driving dogs 23, and these dogs can engage in grooves in a Maltese cross 24 mounted on a shaft 25, on which the disc is mounted. There is thus obtained a gear ratio of 2:1, so that one turn of the wheel 22 turns the disk 13 half a turn. Due to this implementation of the power transmission there is also obtained a momentary break every 90° in the rotation of the disc 13, which facilitates the release of a stopper that has fastened between the gauging members 14 and 15. The shaft 25 can be driven in other ways, e.g. directly by an electric motor, which is controlled such that the same pattern of movement is obtained. The shaft 25 is carried for rotation in bearings mounted in a guide member 26, which is stationary relative the shaft and is also provided with an oval guide groove 27 accommodating two guide pins 28. The guide member 26, with its groove 27 and pins 28 is specially illustrated in Figure 3. As will be seen from Figure 2, the pins 28 moving in the groove 27 are fixed in their respective movable gauging member 14 or 15. It will also be seen from this Figure that there is room behind these members, which allows them to move apart.

When both photocells 19 have sent a signal activating the unillustrated motor driving the shaft 21, the latter is rotated a complete turn, and thus the drive wheel 22 also, which results in that the Maltese cross 24 is rotated half a turn, taking with it the shaft 25, on which the plate 13 is mounted. Since the guide member 26 is stationary relative to this rotation, the guide pins 28 will travel half a turn along the guide groove 27, thus increasing their mutual spacing to a maximum, for returning to the "normal" spacing on completing a turn, as illustrated in Figure 3. Since the gauging members 14 and 15 are fixed to their respective pin, they will also move apart simultaneously as the disc 13 rotates, such that the opening of the channel 16 is turned downwards. A stopper that had fastened in the channel is thus free to be taken away in the direction of the arrow 9. Other types of sensing means than photocells 19 can be used, e.g. capacitive means that sense the presence of a stopper in the channel 16.

A variant of the embodiment of the first sorter 3 is illustrated in figures 4 and 5. The sorting member is provided with fixed dogs here also, but in this case the dogs 4 are equipped with rollers 29 which are rotatably mounted at the ends of the dogs facing towards the central opening 5. The rollers 29 have a diameter which is somewhat greater than the width of the dogs 4, and in this case the given minimum dimension for the stoppers is formed by the spacing between two adjacent rollers 29. In addition, there is a fixed ring 30, coaxial with the sorter 3, and the ring is provided with a circumferential uppstanding flange 31, which is accommoded in a slot in the sorter 3 such that the free end surface of the flange 31 engages against a stopper situated between a pair of rollers 29 and dogs 4. The stopper is thus compelled to rotate about its own axis, and if it has a certain amount of ovality, with a least dimension less than the given distance 7, the stopper will reliably fall down between the two rollers 29 and be sorted out of the apparatus.

A fixed ring 30 and its flange 31, as in the apparatus of figures 4 and 5, can also be arranged in the apparatus of Figure 1, where there are only fixed dogs 4 without rollers. Rotation of the stoppers about their own axes will also be caused here when they move as the sorter rotates.

With the apparatus according to the invention there is thus obtained an excellent appliance for sorting objects that must meet given criteria with respect to both a minimum and a maximum dimension. Since the objects are caused to rotate about their own axes during sorting, objects with not permitted ovality can be reliably discovered. To a certain extent, stoppers that are oval will be already sorted out in the first sorter 3, when the seizing situation between the fixed dogs 4 is changed for the stoppers during rotation of the sorting member, a certain amount of ovality control thus already taking place in the first sorter.

The method and apparatus in accordance with the invention also functions for performing checks on flatness, straightness and perpendicularity. In certain types of use it can also be essential to check the coefficient of friction of the insertion part of a stopper, and even here the inventive method and apparatus can be used, since stoppers with a higher coefficient of friction will have a longer rolling time along the channel 16, and such stoppers will be sorted out in the same way as described above for oval stoppers.

Claims

1. Method of sorting round objects (1), **characterised** in that they are first inserted between a pair of dogs having converging spacing, the least value of which corresponds to the minimum acceptable dimension of the objects, such that an object with too small a dimension can pass between the dogs (4), which, with the object (1) between them are moved such that the object is moved out from the space between the dogs (4) and transferred to a path (16) between two parallel gauging members (14,15) displaceable at right angles to the path, the spacing between said members (14,15) in the normal state corresponding to the greatest acceptable dimension of the objects (1), such that the objects with accepted dimensions pass between said members (14,15), while too large or deformed objects (1) are retained between said members, and in that

the retention of the objects between said members is sensed by a sensor (19), which causes mutual displacement in said members for increasing their spacing to allow the objects (1) to pass between them, simultaneously as said members are rotated about an axis at right angles to the displacement direction of said members and the longitudinal direction of said path (16), such that the objects passing between said members (14,15) are sorted out and taken to a place other than that to which the objects with accepted dimensions are taken, subsquent to which said members are returned to their original spacing and to a position for once again receiving objects (1).

2. Method as claimed in claim 1, **characterised** in that the passage of the objects (1) between said members (14,15) is sensed optically, and in that when the residence time of the objects between said members exceeds a given value the sensor causes said members to be displaced and rotated.

3. Method as claimed in claim 1 or 2, **characterised** in that the movement of the objects (1) in between the fixed dogs (4) and out from them and along the path between said displaceable members (14,15) as well as between said members when displaced and rotated is achieved by the objects rolling solely due to gravity.

4. Method as claimed in any one of claims 1 to 3, **characterised** in that when sorting out objects (1), said members (14,15) are rotated a half turn during their displacement such as come once again into position for receiving objects (1).

5. Apparatus for sorting round objects (1), **characterised** in that it includes a first sorter (3) disposed for receiving round objects (1) from a feed means (2), said sorter (3) being provided with outlet openings (7), through which round objects not complying with a given minimum dimension can be taken away, while objects complying with the minimum dimension can pass said sorter (3) for being led by a device (11) to a second sorter (12) including two substantially parallel gauging members (14,15), which define between them a given maximum dimension for the round objects (1), and in that the second sorter (12) is situated and arranged such that the round objects can pass between said members (14,15) when the objects (1) do not exceed the given maximum dimension, whereas round objects (1) exceeding the given maximum dimension fasten between said members (14,15), and in that the second sorter is equipped with means for taking away objects that have fastened between said members (14,15) or have not passed them during a predetermined maximum time.

6. Apparatus as claimed in claim 5, **characterised** in that the first sorter (3) includes a rotating, paddlewheel-like sorting member with substantially radially directed dogs (4) extending from the outer circumference of the sorting member a distance inwards towards an opening (5) disposed at the centre of the sorting member for taking away rejected objects, the distance (7) between the radially inward ends of the dogs (4) corresponding to the given minimum dimension such that an object exceeding the minimum dimension does not come into the central opening (5), but accompanies the sorting member in its rotating movment for subsequently being presented to a transfer device (11) for taking to the second sorter (12).

7. Apparatus as claimed in claim 5, **characterised** in that the first sorter (3) includes a rotating, paddlewheel-like sorting member with substantially radially directed dogs (4) extending from the outer circumference of the sorting member a distance inwards towards an opening (5) disposed at the centre of the sorting member for taking away rejected objects, the ends of the dogs (4) facing towards the opening (5) being provided with rotatably mounted rollers (29) and the distance (7) between two adjacent rollers (29) corresponding to the given minimum dimension, such that objects exceeding the minimum dimension do not come into the central opening (5) but accompany the sorting member in its rotating movement for subsequently being presented to a transfer device (11) for taking to the second sorter (12).

8. Apparatus as claimed in claim 7, **characterised** in that a touch means (31) is arranged to engage against a stopper (1) which is in contact with a pair of rollers (29) for causing the stopper to rotate about its own axis when the sorter (3) is rotating.

9. Apparatus as claimed in any one of claims 5-8, **characterised** in that the second sorter includes a rotatable plate (13) on which the gauging members (14,15) are mounted, and in that when the plate (13) is rotated said members will be displaced away from each other.

10. Apparatus as claimed in claim 9, **characterised** in that both said members (14,15) are urged by springs (18) into a mutual spacing defining the given maximum dimension and that said members (14,15) engage, with the aid of guide pins (28) in a guide groove (27) in an unrotatable guide member (26), said groove (27) extending in an oval shape for causing the displaceable gauging members (14,15) to be moved apart when the plate (13) with the gauging members is rotated.

11. Apparatus as claimed in either of claims 9 and 10, **characterised** in that sensing means (19) are arranged outside the ends of the channel (16) formed by the displaceable gauging members (14,15) for sensing the presence of an object (1) in the channel between said members (14,15).

12. Apparatus as claimed in claim 11, **characterised** in that the sensing means (19) are photocells.

13. Apparatus as claimed in either of claims 11 and 12, **characterised** in that the sensing

means (19) activates the rotation of the rotatable plate (13).

14. Apparatus as claimed in claim 13, **characterised** in that the sensing means (19) is provided with a time sensor which activates the rotation of the plate (13) when an object (1) has not managed to pass the channel (16) between the displaceable gauging members (14,15) during a given, predetermined time.

15. Apparatus as claimed in any one of claims 5-14, **characterised** in that in their normal position, the substantially parallel gauging members (14,15) in the second sorter (12) are arranged at an angle to the vertical such that a round object (1) that is to pass between said members is caused to roll with the aid of gravity between said members.

FIG.1

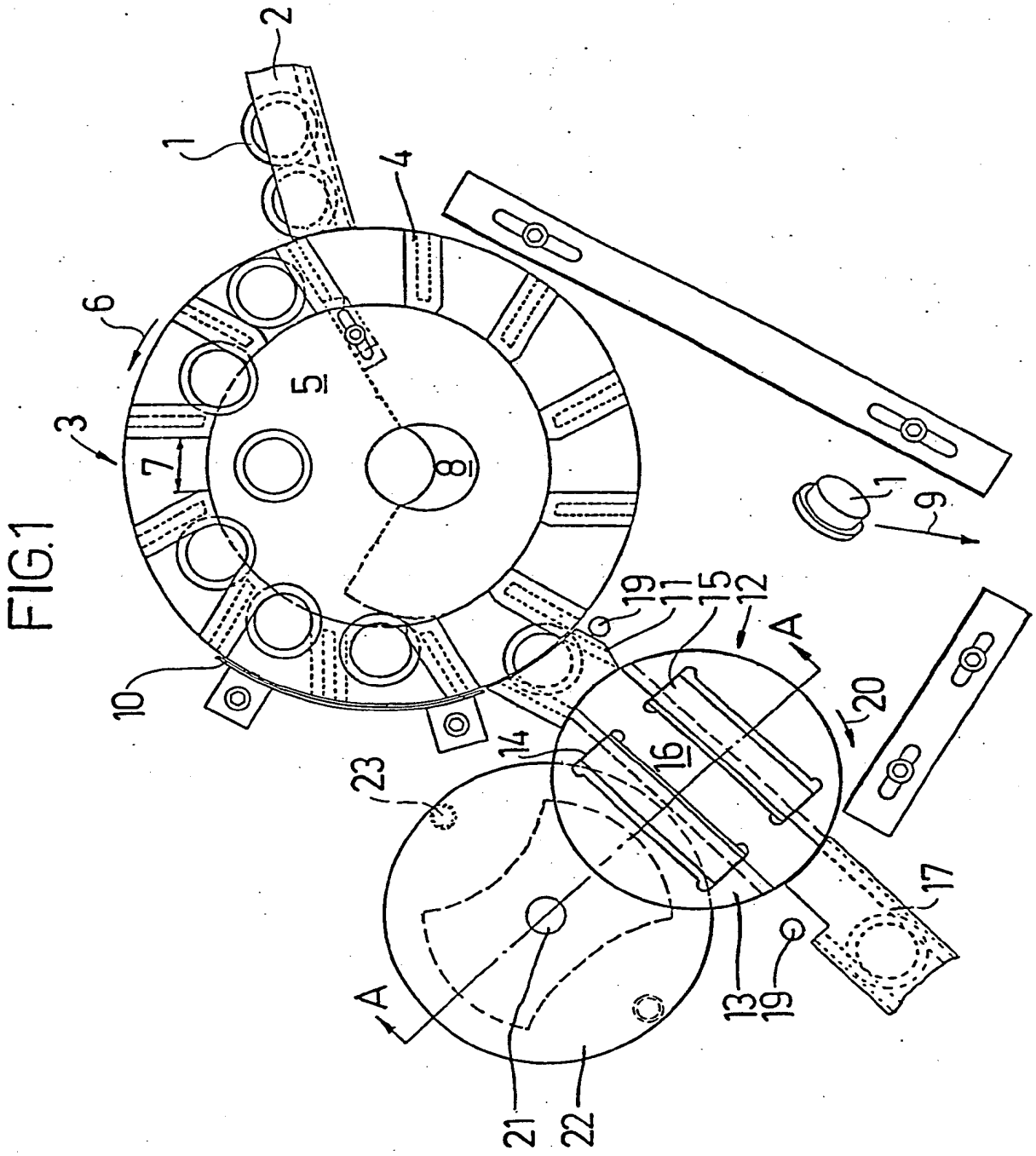


FIG.2

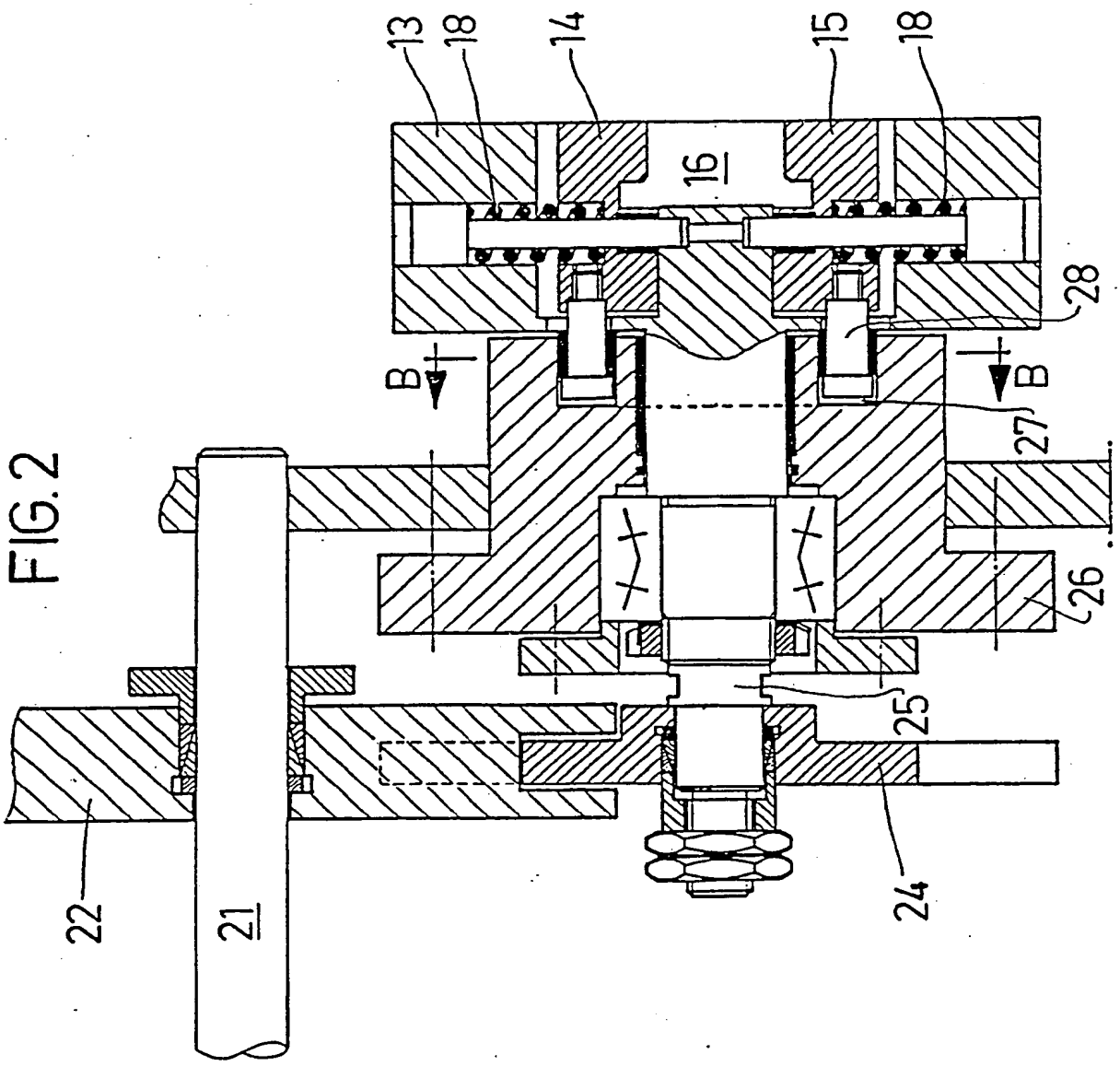


FIG.3

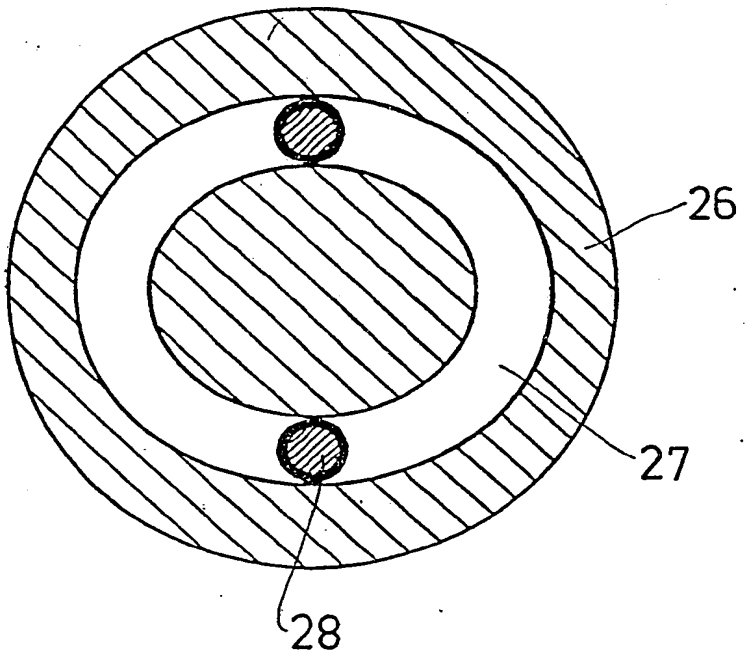


FIG.5

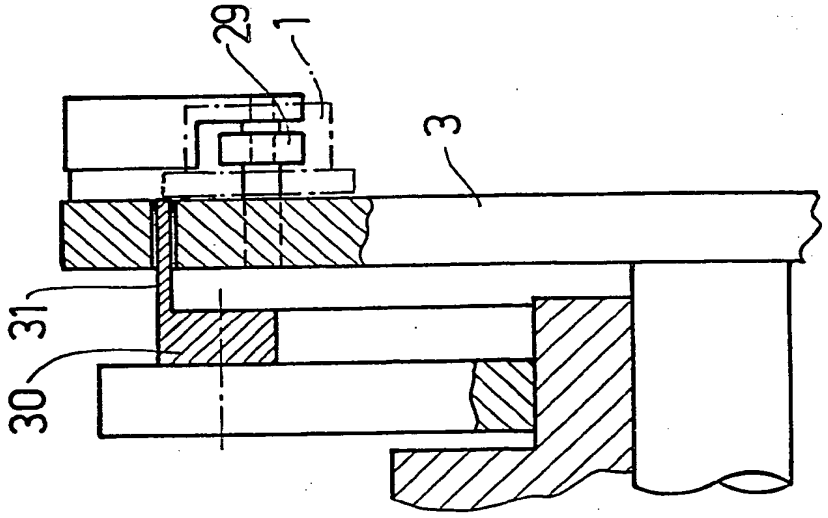
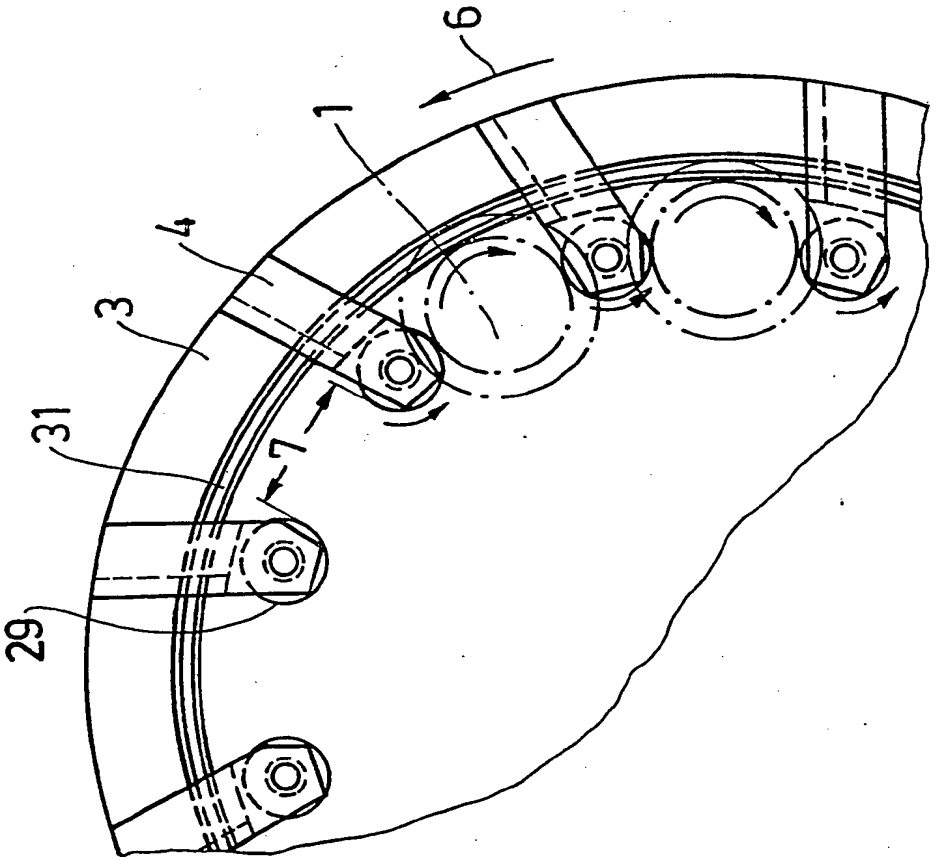


FIG.4



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EUROPEAN SEARCH REPORT

Application number
89850086.3

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int Cl 4)
A	CH-A5- 525 724 (BRASSEL E.) * See spec the main claim and fig 1 *	1,5	B 07 c 5/06
A	US-A- 2 680 516 (SCHUITEMA A.) * Whole document *		
A	Derwent's abstract No 84-255142/41, SU 1072-929-A (PAVLODARSK AUTOMN) * Whole document *		
A	FR-A5-2 161 158 (COMMISARIAT A L'ENERGIE ATOMIQUE) * Whole document *		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 07 C
G 07 D
G 07 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	16-06-1989	BENGTSSON R.

CATEGORY OF CITED DOCUMENTS

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